USPTO Customer No. 25280

Case# 5393

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	Delwin Jackson, et al.
Serial Number:	10/027,433
Filed:	December 21, 2001
For:	Low-Temperature Method of Producing An Antimicrobial, Durable Coating For Hard Surface Substrates
Group Art Unit:	1762
Examiner:	Michael E. Barr

BRIEF ON APPEAL UNDER 37 CFR 1.192

Mail Stop Appeal Brief
Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Sir:

Certificate of Mailing Under 37 CFR § 1.8

I hereby certify that this correspondence, and all correspondence referenced herein as being enclosed with this correspondence, is being deposited with the United States Postal Service in an envelope addressed to "Mail Stop Appeal Brief, Commissioner for Patents, PO Box 1450, Alexandria, Virginia 22313-1450" with sufficient postage on October 20, 2003.

Signature: Alissa Kohlman
Name: Alissa D. Kohlman

The following Appeal Brief is submitted pursuant to the Notice of Appeal filed on or about August 27, 2003, from the Final Office Action dated May 27, 2003.

I. REAL PARTY IN INTEREST

The above-referenced application is the subject of an assignment to Milliken & Company, located at 920 Milliken Road, Spartanburg, South Carolina, which is the real party in interest.

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Appellant is not aware of any other appeal or interference that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

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Claims 1-5, 8, and 13-17 have been rejected and are the subject of this Appeal.

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V. SUMMARY OF THE INVENTION

The subject application is directed to low temperature manufacture of sol-gel films for the coating of hard surface substrates, wherein such sol-gel films exhibit effective and durable antimicrobial properties.

Claim 1 is directed to a method of producing an antimicrobial hard surface substrate comprising the steps of: (a) providing a hard surface substrate; (b) providing a sol-gel precursor formulation comprising a host precursor component and at least one metal-containing antimicrobial agent selected from the group consisting of metal-containing ion-exchange compounds, metal-containing zeolites, metal-containing glasses, and any mixtures thereof; (c) compounding the sol-gel film precursor formulation to produce an adhesive sol-gel coating composition; (d) applying the sol-gel coating composition to at least a portion of the hard surface substrate; and (e) exposing the sol-gel coated hard surface substrate to a temperature of at most 800°C to form a finished sol-gel film-coated hard surface substrate, wherein the finished substrate exhibits a log kill rate for *Klebsiella pneumoniae* of at least 0.5 as measured under modified plate contact method, the method being JIS Z2801:2000 utilizing a phosphate buffer solution. The features of claim 1 are described, for example, on pages 13 – 16 of the specification, including the information in the Table (p. 14) and in Experimental Data Table 1 (p. 16).

Claim 2 depends from claim 1 and specifies a log kill rate for *Klebsiella pneumoniae* of at least 1.0. Claims 3-5 each depend from claims 2-4 and specify a log kill rate for *Klebsiella pneumoniae* of at least 2.0, 3.0, and 3.5, respectively. These values are supported, for example, on page 16 of the specification in Experimental Data Table 1.

Claim 8 depends from claim 1 and specifies that the host precursor (which is mentioned in step b of claim 1) is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof. These host precursors are listed, for example, on page 10 of the specification at lines 3-7.

Claims 13-16 each depend from claims 2-5, respectively. These claims specify that the host cursor (which is mentioned in step b of claim 1) is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any

mixtures thereof. These host precursors are listed, for example, on page 10 of the specification at lines 3-7.

Claim 17 depends from claim 1 and specifies that the metal-containing antimicrobial agent (which is mentioned in step b of claim 1) is a silver-containing ion-exchange compound. This limitation is mentioned, for example, on page 7 of the specification at lines 18-21.

VI. ISSUES

At issue in the present Appeal are:

Whether Claims 1-5, 8, and 13-17 are properly rejected under 35 USC 103(a) as being unpatentable over Oku et al. (US Patent 5,882,808) in view of Deith (WO 91/08179).

VII. GROUPING OF CLAIMS

Appellant respectfully submits that all of the claims stand together.

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The Office has rejected Claims 1-5, 8, and 13-17 as being unpatentable under 35 USC 103(a) over Oku et al. (US Patent No. 5,882,808) in view of Deith (WO 91/08179).

Oku et al. disclose an anti-bacterial and anti-fungal glaze composition for ceramic products formed by incorporating a silver-containing substance and a fire resistant material and/or an oxide glass composition, while Deith discloses the application of glass-like glazes to pottery ware and ceramic tiles.

More specifically, Oku et al. teaches applying an antimicrobial agent to a substrate by providing a ceramic substrate, providing a conventional silica-based glaze containing an antimicrobial agent (silver oxide, silver-containing ion exchange compound), applying the glaze to the substrate and heating at temperatures of about 1200°C to form a finished coating on the substrate (col. 1, line 50; col. 2, line 18; col. 3, lines 3-32; Example 1).

It is specifically acknowledged by the Office that Oku et al. fail to teach applying the microbial agent with a sol-gel as claimed by Appellant (Paper 7, page 3). Thus, the Office combines the teachings of Oku et al. with Deith to reject claims 1-5, 8, and 13-17.

Deith teaches applying a silica-based glaze to a ceramic substrate by a sol-gel method, as an alternative to a conventional, high temperature firing glaze, wherein the glaze is formed by providing a sol-gel precursor formulation comprising a host precursor component, allowing the formulation to form a sol-gel, applying the sol-gel to the substrate and heating at temperatures of about 500°C to form a finished coating on the substrate (page 3, lines 12-34; Example).

It is specifically acknowledged by the Office that Oku et al. and Deith do not teach the log kill rate for *Klebsiella pneumoniae* as claimed by Appellant (Paper 5, page 4).

The Office's argument with regard to Appellant's claims 1-5, 8, and 13-17 is as follows:

> The Office believes it would have been an obvious modification for one skilled in the art to apply the glaze of Oku et al. by the sol-gel method of Deith, where antimicrobial agent is merely added to the sol-gel glaze composition, with the expectation of gaining the additional benefit of providing the desired ceramic glaze layer in Oku et al. at lower heat treating temperatures than with the conventional glaze of Oku et al., as is taught by Deith (Paper 5, page 4).
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> Additionally, the Office believes it would have been expected that the finished substrate would have inherently had the claimed log kill rate for *Klebsiella pneumoniae.* Further, the Office states that if this is not the case, then it must be due to critical limitations not being claimed; and the mere observation of another benefit from an otherwise old process does not form the basis for patentability (Paper 5, page 4).

Appellant respectfully believes that the rejection of claims 1-5, 8, and 13-17 under 35 § 103 (a) as being unpatentable over Oku et al. (US Patent No. 5,882,808) in view of Deith (WO 91/08179) is in error and should be withdrawn on the grounds that the rejection is based on improper hindsight relying upon the present application as a necessary motivation or suggestion for combining such references. Indeed, Appellant's claim 1 is directed to a process for providing an antimicrobial, durable coating for hard surface substrates comprising the steps of, *inter alia*: "exposing said sol-gel coated hard surface substrate to a temperature of at most about 800°C to form a finished sol-gel film-coated hard surface substrate." The Oku et al. reference is specifically directed to a glaze composition that is "dried and then baked for 1 hour at a temperature of 1200°C" (col. 5, lines 34-35 which describe Examples 1-12). Thus, the Oku et al. reference actually teaches away from heating the coating at a temperature of at most 800°C to form a coated hard surface substrate. Further, even if one were strangely motivated to combine Oku et al. with Deith in the manner suggested by the Office, the resulting coating would not fall within the scope of Appellant's claims.

Appellant submits that Office's reliance on Deith to overcome the shortcomings of Oku et al. is misplaced, for the reasons set forth below.

Appellant believes it to be well-established that a proper reference must be within the field of the inventor's endeavor, and also must be reasonably pertinent to the inventor's problem.

> "...the purposes of both the invention and the prior art are important in determining whether the reference is reasonably pertinent to the problem the invention attempts to solve. If a reference disclosure has the same purpose as the claimed invention, the reference relates to the same problem, and that fact supports use of that reference in an obviousness rejection. An inventor may well have been motivated to consider the reference when making his invention. If it is directed to a different purpose, the inventor would accordingly have had less motivation or occasion to consider it." *In re Clay*, 966 F.2d 656, 23 USPQ2d 1767 (Fed. Cir. 1992).
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> "[I]t is necessary to consider the 'reality of the circumstances',...-- in other words, common sense -- in deciding in which field a person of ordinary skill would

> reasonably be expected to look for a solution to the problem facing the inventor... The combination of elements from non-analogous sources, in a manner that reconstructs the applicant's invention only with the benefit of hindsight, is insufficient to present a prima facie case of obviousness." *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

As to the purpose of Deith, creating an antimicrobial sol-gel coating for hard surface substrates, a stated objective of Appellant's invention, is not an advantage associated with the teachings of Deith. Alternatively, Deith's stated objectives are (a) to provide a durable overglaze for pottery ware, that is decorated with color or precious metal transfers, without interfering with the decoration (page 3, lines 24-28) and (b) to prevent loss of lead from the conventional glaze, which typically occurs in a dishwashing machine (page 2, lines 30-34).

For the reasons set forth above, Appellant respectfully asserts that Deith is neither within the field of Appellant's invention (antimicrobial sol-gel coatings for hard surface substrates), nor is it clearly pertinent to the problem of creating microbe-inhibiting coatings for hard surface substrates, a problem clearly addressed by Appellant's invention. Therefore, Appellant believes there is no reasonable basis for concluding that Deith would have been considered by one skilled in the particular art of antimicrobial sol-gel coatings for hard surface substrates working on the pertinent problem of inhibiting microbial growth of the hard surface substrate.

Thus, Appellant respectfully asserts that neither Oku et al. nor Deith provide the necessary motivation or suggestion for combination. Modification of the primary Oku et al. reference in light of the disclosure of Deith would destroy the function of the primary reference and is taught away from by the references themselves. As stated above, Oku et al. teaches away from the present invention, and Deith is not in the field of Appellant's endeavor of antimicrobial coatings for hard surface substrates. Neither reference discloses the present invention, either alone or in combination.

IX. CONCLUSION

For the reasons set forth above, Appellant respectfully urges that the rejections of Claims 1-5, 8, and 13-17 are improper. Reversal of all rejections in this Appeal is hereby requested.

A copy of pending Claims 1-5, 8, and 13-17 is attached as an Appendix hereto.

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Respectfully submitted,

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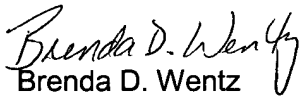

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APPENDIX

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c) compounding said sol-gel film precursor formulation to produce an adhesive sol-gel coating composition;

d) applying said sol-gel coating composition to at least a portion of said hard surface substrate; and

e) exposing said sol-gel coated hard surface substrate to a temperature of at most about 800°C to form a finished sol-gel film-coated hard surface substrate,

wherein said finished substrate exhibits a log kill rate for *Klebsiella pneumoniae* of at least 0.5 as measured under a modified plate contact method being JIS Z2801:2000 utilizing a phosphate buffer solution.

2. The method of Claim 1 wherein the log kill rate is at least 1.0.

3. The method of Claim 2 wherein the log kill rate is at least 2.0.

4. The method of Claim 3 wherein the log kill rate is at least 3.0.

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13. The method of Claim 2 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

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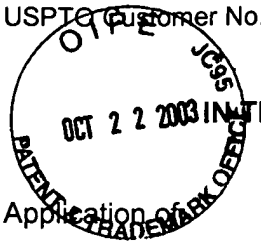

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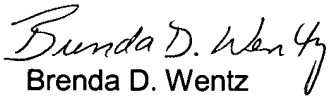

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10. (cancelled)

11. (cancelled)

12. (cancelled)

13. The method of Claim 2 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

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15. The method of Claim 4 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

16. The method of Claim 5 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

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The above-referenced application is the subject of an assignment to Milliken & Company, located at 920 Milliken Road, Spartanburg, South Carolina, which is the real party in interest.

II. RELATED APPEALS & INTERFERENCES

Appellant is not aware of any other appeal or interference that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-5, 8, and 13-17 have been rejected and are the subject of this Appeal.

IV. STATUS OF AMENDMENTS

No Amendments were filed after the Final Office Action.

V. SUMMARY OF THE INVENTION

The subject application is directed to low temperature manufacture of sol-gel films for the coating of hard surface substrates, wherein such sol-gel films exhibit effective and durable antimicrobial properties.

Claim 1 is directed to a method of producing an antimicrobial hard surface substrate comprising the steps of: (a) providing a hard surface substrate; (b) providing a sol-gel precursor formulation comprising a host precursor component and at least one metal-containing antimicrobial agent selected from the group consisting of metal-containing ion-exchange compounds, metal-containing zeolites, metal-containing glasses, and any mixtures thereof; (c) compounding the sol-gel film precursor formulation to produce an adhesive sol-gel coating composition; (d) applying the sol-gel coating composition to at least a portion of the hard surface substrate; and (e) exposing the sol-gel coated hard surface substrate to a temperature of at most 800°C to form a finished sol-gel film-coated hard surface substrate, wherein the finished substrate exhibits a log kill rate for *Klebsiella pneumoniae* of at least 0.5 as measured under modified plate contact method, the method being JIS Z2801:2000 utilizing a phosphate buffer solution. The features of claim 1 are described, for example, on pages 13 – 16 of the specification, including the information in the Table (p. 14) and in Experimental Data Table 1 (p. 16).

Claim 2 depends from claim 1 and specifies a log kill rate for *Klebsiella pneumoniae* of at least 1.0. Claims 3-5 each depend from claims 2-4 and specify a log kill rate for *Klebsiella pneumoniae* of at least 2.0, 3.0, and 3.5, respectively. These values are supported, for example, on page 16 of the specification in Experimental Data Table 1.

Claim 8 depends from claim 1 and specifies that the host precursor (which is mentioned in step b of claim 1) is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof. These host precursors are listed, for example, on page 10 of the specification at lines 3-7.

Claims 13-16 each depend from claims 2-5, respectively. These claims specify that the host cursor (which is mentioned in step b of claim 1) is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any

mixtures thereof. These host precursors are listed, for example, on page 10 of the specification at lines 3-7.

Claim 17 depends from claim 1 and specifies that the metal-containing antimicrobial agent (which is mentioned in step b of claim 1) is a silver-containing ion-exchange compound. This limitation is mentioned, for example, on page 7 of the specification at lines 18-21.

VI. ISSUES

At issue in the present Appeal are:

Whether Claims 1-5, 8, and 13-17 are properly rejected under 35 USC 103(a) as being unpatentable over Oku et al. (US Patent 5,882,808) in view of Deith (WO 91/08179).

VII. GROUPING OF CLAIMS

Appellant respectfully submits that all of the claims stand together.

VIII. ARGUMENT

Whether Claims 1-5, 8, and 13-17 are properly rejected under 35 USC 103(a) as being unpatentable over Oku et al. (US Patent 5,882,808) in view of Deith (WO 91/08179).

The Office has rejected Claims 1-5, 8, and 13-17 as being unpatentable under 35 USC 103(a) over Oku et al. (US Patent No. 5,882,808) in view of Deith (WO 91/08179).

Oku et al. disclose an anti-bacterial and anti-fungal glaze composition for ceramic products formed by incorporating a silver-containing substance and a fire resistant material and/or an oxide glass composition, while Deith discloses the application of glass-like glazes to pottery ware and ceramic tiles.

More specifically, Oku et al. teaches applying an antimicrobial agent to a substrate by providing a ceramic substrate, providing a conventional silica-based glaze containing an antimicrobial agent (silver oxide, silver-containing ion exchange compound), applying the glaze to the substrate and heating at temperatures of about 1200°C to form a finished coating on the substrate (col. 1, line 50; col. 2, line 18; col. 3, lines 3-32; Example 1).

It is specifically acknowledged by the Office that Oku et al. fail to teach applying the microbial agent with a sol-gel as claimed by Appellant (Paper 7, page 3). Thus, the Office combines the teachings of Oku et al. with Deith to reject claims 1-5, 8, and 13-17.

Deith teaches applying a silica-based glaze to a ceramic substrate by a sol-gel method, as an alternative to a conventional, high temperature firing glaze, wherein the glaze is formed by providing a sol-gel precursor formulation comprising a host precursor component, allowing the formulation to form a sol-gel, applying the sol-gel to the substrate and heating at temperatures of about 500°C to form a finished coating on the substrate (page 3, lines 12-34; Example).

It is specifically acknowledged by the Office that Oku et al. and Deith do not teach the log kill rate for *Klebsiella pneumoniae* as claimed by Appellant (Paper 5, page 4).

The Office's argument with regard to Appellant's claims 1-5, 8, and 13-17 is as follows:

> The Office believes it would have been an obvious modification for one skilled in the art to apply the glaze of Oku et al. by the sol-gel method of Deith, where antimicrobial agent is merely added to the sol-gel glaze composition, with the expectation of gaining the additional benefit of providing the desired ceramic glaze layer in Oku et al. at lower heat treating temperatures than with the conventional glaze of Oku et al., as is taught by Deith (Paper 5, page 4).
>
> Additionally, the Office believes it would have been expected that the finished substrate would have inherently had the claimed log kill rate for *Klebsiella pneumoniae*. Further, the Office states that if this is not the case, then it must be due to critical limitations not being claimed; and the mere observation of another benefit from an otherwise old process does not form the basis for patentability (Paper 5, page 4).

Appellant respectfully believes that the rejection of claims 1-5, 8, and 13-17 under 35 § 103 (a) as being unpatentable over Oku et al. (US Patent No. 5,882,808) in view of Deith (WO 91/08179) is in error and should be withdrawn on the grounds that the rejection is based on improper hindsight relying upon the present application as a necessary motivation or suggestion for combining such references. Indeed, Appellant's claim 1 is directed to a process for providing an antimicrobial, durable coating for hard surface substrates comprising the steps of, *inter alia*: "exposing said sol-gel coated hard surface substrate to a temperature of at most about 800°C to form a finished sol-gel film-coated hard surface substrate." The Oku et al. reference is specifically directed to a glaze composition that is "dried and then baked for 1 hour at a temperature of 1200°C" (col. 5, lines 34-35 which describe Examples 1-12). Thus, the Oku et al. reference actually teaches away from heating the coating at a temperature of at most 800°C to form a coated hard surface substrate. Further, even if one were strangely motivated to combine Oku et al. with Deith in the manner suggested by the Office, the resulting coating would not fall within the scope of Appellant's claims.

Appellant submits that Office's reliance on Deith to overcome the shortcomings of Oku et al. is misplaced, for the reasons set forth below.

Appellant believes it to be well-established that a proper reference must be within the field of the inventor's endeavor, and also must be reasonably pertinent to the inventor's problem.

> "...the purposes of both the invention and the prior art are important in determining whether the reference is reasonably pertinent to the problem the invention attempts to solve. If a reference disclosure has the same purpose as the claimed invention, the reference relates to the same problem, and that fact supports use of that reference in an obviousness rejection. An inventor may well have been motivated to consider the reference when making his invention. If it is directed to a different purpose, the inventor would accordingly have had less motivation or occasion to consider it." *In re Clay*, 966 F.2d 656, 23 USPQ2d 1767 (Fed. Cir. 1992).

> "[I]t is necessary to consider the 'reality of the circumstances',...-- in other words, common sense -- in deciding in which field a person of ordinary skill would

> reasonably be expected to look for a solution to the problem facing the inventor... The combination of elements from non-analogous sources, in a manner that reconstructs the applicant's invention only with the benefit of hindsight, is insufficient to present a prima facie case of obviousness." *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

As to the purpose of Deith, creating an antimicrobial sol-gel coating for hard surface substrates, a stated objective of Appellant's invention, is not an advantage associated with the teachings of Deith. Alternatively, Deith's stated objectives are (a) to provide a durable overglaze for pottery ware, that is decorated with color or precious metal transfers, without interfering with the decoration (page 3, lines 24-28) and (b) to prevent loss of lead from the conventional glaze, which typically occurs in a dishwashing machine (page 2, lines 30-34).

For the reasons set forth above, Appellant respectfully asserts that Deith is neither within the field of Appellant's invention (antimicrobial sol-gel coatings for hard surface substrates), nor is it clearly pertinent to the problem of creating microbe-inhibiting coatings for hard surface substrates, a problem clearly addressed by Appellant's invention. Therefore, Appellant believes there is no reasonable basis for concluding that Deith would have been considered by one skilled in the particular art of antimicrobial sol-gel coatings for hard surface substrates working on the pertinent problem of inhibiting microbial growth of the hard surface substrate.

Thus, Appellant respectfully asserts that neither Oku et al. nor Deith provide the necessary motivation or suggestion for combination. Modification of the primary Oku et al. reference in light of the disclosure of Deith would destroy the function of the primary reference and is taught away from by the references themselves. As stated above, Oku et al. teaches away from the present invention, and Deith is not in the field of Appellant's endeavor of antimicrobial coatings for hard surface substrates. Neither reference discloses the present invention, either alone or in combination.

IX. CONCLUSION

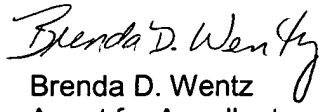
For the reasons set forth above, Appellant respectfully urges that the rejections of Claims 1-5, 8, and 13-17 are improper. Reversal of all rejections in this Appeal is hereby requested.

A copy of pending Claims 1-5, 8, and 13-17 is attached as an Appendix hereto.

The Commissioner is hereby authorized to charge the Appeal Brief fee of $330.00 to Deposit Account No. 04-0500. The Commissioner is also authorized to charge any additional fees that may be required, or credit any over-payment, to Deposit Account No. 04-0500. This Appeal Brief is being submitted in triplicate.

Respectfully submitted,

October 20, 2003



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APPENDIX

1. A method of producing an antimicrobial hard surface substrate comprising the steps of

a) providing a hard surface substrate;

b) providing a sol-gel precursor formulation comprising a host precursor component and at least one metal-containing antimicrobial agent selected from the group consisting of metal-containing ion-exchange compounds, metal-containing zeolites, metal-containing glasses, and any mixtures thereof;

c) compounding said sol-gel film precursor formulation to produce an adhesive sol-gel coating composition;

d) applying said sol-gel coating composition to at least a portion of said hard surface substrate; and

e) exposing said sol-gel coated hard surface substrate to a temperature of at most about 800°C to form a finished sol-gel film-coated hard surface substrate,

wherein said finished substrate exhibits a log kill rate for *Klebsiella pneumoniae* of at least 0.5 as measured under a modified plate contact method being JIS Z2801:2000 utilizing a phosphate buffer solution.

2. The method of Claim 1 wherein the log kill rate is at least 1.0.

3. The method of Claim 2 wherein the log kill rate is at least 2.0.

4. The method of Claim 3 wherein the log kill rate is at least 3.0.

5. The method of Claim 4 wherein the log kill rate is at least 3.5.

6. (cancelled)

7. (cancelled)

8. The method of Claim 1 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

9. (cancelled)

10. (cancelled)

11. (cancelled)

12. (cancelled)

13. The method of Claim 2 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

14. The method of Claim 3 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

15. The method of Claim 4 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

16. The method of Claim 5 wherein said host precursor is selected from the group consisting of TMOS, TEOS, aluminum acetylacetonate, titanium acetylacetonate, zirconium acetylacetonate, and any mixtures thereof.

17. The method of Claim 1 wherein said metal-containing antimicrobial agent is a silver-containing ion-exchange compound.